EVALUATION OF SOYA BEAN MILK AS AN ANTACID

By W. P. Fung and C. Y. Tye

SYNOPSIS

The duration of neutralisation following intragastric antacid (SIMECO) and soya bean milk was determined in 20 subjects. In 10 of these subjects, the test was also done for water. The results confirm that both the antacid (SIMECO) and soya bean milk were able to neutralise the acid gastric juice to a pH above 3·0. Water was unable to do this. The mean duration of neutralisation was 30 and 10·75 minutes for the antacid (SIMECO) and soya bean juice, respectively. The difference was statistically significant. It is concluded that soya bean juice has neutralising properties like an antacid, but is significantly less effective than a standard antacid like SIMECO. It has, however, advantages over antacids since it is a natural foodstuff, and hence, devoid of any side-effects.

INTRODUCTION

Antacid preparations have been used in the treatment of peptic ulceration for a very long time. Although they have not been shown to be effective in healing the ulcer, it has been established that antacids will relieve pain (Lawrence, 1952; Doll *et al*, 1956). It appears that the pain in peptic ulceration is related to the pH of the gastric contents, the pain being relieved when the gastric pH is raised to above 3·0. The aim of antacid therapy is thus to elevate the pH of the gastric contents, especially to a pH of about 5·0 when the proteolytic activity of gastric pepsin is virtually abolished (Piper, 1967). As soya bean juice is a very common drink in Singapore, it was decided to study this to determine whether soya bean juice has any neutralising properties like an antacid. To our knowledge, this is the first report of an evaluation of soya bean milk as an antacid.

MATERIAL AND METHOD

The method of evaluation was based on that of Littman (1967). Patients with peptic ulceration and hypersecretion of gastric HCl were used. After an overnight fast, a double-lumen nasogastric tube (Salem) was inserted in the morning. Two specimens of basal gastric juice were obtained at 15 minute intervals, and the pH estimated. The study was done only if both basal samples had a pH of below 2·5. A standard commercial antacid (SIMECO) was used and 15 ml. of this, made up to 150 ml. with water, was introduced into the stomach via the nasogastric tube. Gastric contents were sucked out completely at 10 minute intervals. The gastric juice was thoroughly mixed, and, after a 5 ml. sample was taken for pH estimation, the remainder was re-introduced into the stomach via the tube. When the pH of 2 consecutive samples fell below 3·0, the neutralising effect was arbitrarily considered to be at an end. At this point, 150 ml. of soya bean juice was introduced into the stomach and the procedure repeated. Finally, the test was done with 150 ml. of water (only in 10 of the 20 cases). The effectiveness of each test substance was expressed as the time (in minutes) during which the pH remained above 3·0 i.e. the duration of neutralisation. The 20 subjects used were made up of 8 patients with chronic duodenal ulcer, 5 patients with gastric ulcer, and 7 patients with clinical peptic ulcer. The duodenal and gastric ulceration were proven by barium meal and/or gastroscopy. SIMECO was a commercial antacid made by Wyeth Laboratories, and contains aluminium hydroxide, magnesium hydroxide and simethicone. The soya bean juice was obtained commercially in bottled form (manufactured locally in Singapore).

RESULTS

The age, sex, race, and duration of neutralisation of the 20 cases are shown in Table I. The mean duration of neutralisation (± S.D.) for SIMECO, soya bean juice, and water are shown in Table II. Statistical analysis of the results (Tables I to III) showed the following:

1. The mean duration of neutralisation for soya bean juice was 10·75 minutes. This was significantly greater than that for water, which did not have any neutralising power at all.

Department of Medicine (Medical Unit 2), Faculty of Medicine, University of Singapore, Singapore 3.
W. P. FUNG, M.D.(S'pore), F.R.A.C.P., F.A.C.G., Senior Lecturer and Consultant Physician.
Department of Social Medicine and Public Health, University of Singapore.
C. Y. TYE, B.A., Senior Lecturer (Statistics).

TABLE I

THE AGE, SEX, RACE, CLINICAL DIAGNOSIS, AND DURATION OF NEUTRALISATION IN THE 20 SUBJECTS STUDIED

Case No.	Age (yrs.)	Sex	Race	Clinical Diagnosis	Duration of Neutralisation (Minutes)		
					Simeco	Soya Bean Juice	Water
1	32	M	Ch	Duodenal Ulcer	55	0	—
2	17	M	Ch	Duodenal Ulcer	65	35	—
3	18	F	Mal	Gastric Ulcer	15	15	—
4	32	M	Ch	Duodenal Ulcer	15	5	—
5	23	M	Ch	Peptic Ulcer	25	15	—
6	20	M	Ch	Gastric Ulcer	45	25	—
7	16	M	Ch	Gastric Ulcer	35	15	—
8	23	M	Ch	Duodenal Ulcer	15	5	—
9	18	M	Ch	Peptic Ulcer	35	15	0
10	25	M	Ch	Duodenal Ulcer	15	0	0
11	26	M	Ch	Peptic Ulcer	25	0	0
12	25	M	Ch	Duodenal Ulcer	15	5	0
13	18	M	Ch	Gastric Ulcer	35	15	—
14	19	F	Ch	Peptic Ulcer	55	0	—
15	20	M	Ch	Duodenal Ulcer	5	5	0
16	22	M	Ch	Gastric Ulcer	15	5	0
17	20	F	Ch	Peptic Ulcer	55	25	0
18	28	M	Ch	Duodenal Ulcer	35	5	0
19	18	M	Ch	Peptic Ulcer	25	0	0
20	27	M	Ch	Peptic Ulcer	15	25	0

M = Male, F = Female, Ch = Chinese, Mal = Malay.

TABLE II

THE MEAN (± S.D.) DURATION OF NEUTRALISATION FOR THE ANTACID (SIMECO), SOYA BEAN JUICE, AND WATER

Test Substance	n	Duration of Neutralisation (Minutes)	
		Mean	S.D.
SIMECO	20	30·00	17·321
SOYA BEAN JUICE	20	10·75	10·422
WATER	10	0	0

TABLE III

STATISTICAL ANALYSIS OF THE DATA GIVEN IN TABLE II

Substances Compared	t	n	p
Soya Bean Juice VS Water	3·233	28	<0·01
Simeco VS Water	5·429	28	<0·001
Soya Bean Juice VS Simeco	4·259	38	<0.001

TABLE V

THE MEAN (± S.D.) OF pH VALUES AT VARIOUS INTERVALS FOR THE 3 TEST SUBSTANCES

Test Substance	n	Mean (& S.D.) of pH Values at		
		Start	10 Minutes	20 Minutes
SIMECO	20	5·69 (1·158)	4·47 (1·113)	3·28 (0·856)
SOYA BEAN JUICE	20	4·21 (1·279)	3·18 (0·964)	—
WATER	10	2·22 (0·300)	1·90 (0·320)	—

TABLE IV

PERCENTAGE OF SUBJECTS NEUTRALISED AT VARIOUS INTERVALS, BY THE 3 TEST SUBSTANCES

Test Substance	n	Percentage of Subjects with Neutralisation (>pH 3·0)				
		Start	Duration (Minutes) After Start			
			10	20	30	40
Simeco	20	100	95	60	45	25
Soya Bean Juice	20	75	45	20	5	0
Water	10	0	0	0	0	0

TABLE VI

STATISTICAL ANALYSIS OF THE DATA GIVEN IN TABLE V

Test Substances	Mean pH at Start		Mean pH at 10 Minutes	
	t	p	t	p
Soya Bean Juice VS Water	4·820	<0·001	4·052	<0·001
Simeco VS Water	9·258	<0·001	7·104	<0·001
Soya Bean Juice VS Simeco	3·842	<0·001	3·927	<0·001

2. The mean duration of neutralisation for SIMECO was 30·0 minutes. This was significantly greater than water.
3. The neutralising effectiveness of soya bean juice was significantly less than that of SIMECO. Soya bean juice was about 1/3 that of SIMECO in effectiveness as an antacid.

Table IV shows the percentage of subjects with neutralisation at various intervals from the start. At 10 minutes, almost all subjects were neutralised by SIMECO, but only less than half were neutralised by soya bean juice. At 40 minutes, no cases were neutralised by soya bean juice, but a quarter of the subjects were still being neutralised by SIMECO. Water was not able to neutralise any subject even at the start.

Tables V and VI show that the mean pH values for SIMECO and soya bean juice were significantly higher than that for water, at the start of the test and 10 minutes later. The gastric pH never went above 2·5 after intragastric introduction of 150 ml. of water. Statistical analysis also showed that the mean pH values for SIMECO were significantly higher than that for soya bean juice, at the start of the test and 10 minutes later.

DISCUSSION

Antacids have not been shown to be effective in the healing of peptic ulcer (both duodenal and gastric). They are, however, valuable in the relief of peptic ulcer pains. It appears that when the gastric pH is raised to above 3·0, the pain of peptic ulceration tends to subside. Furthermore, the proteolytic activity of gastric pepsin becomes almost absent at a gastric pH of 5·0 and above. The rationale of antacid therapy is thus to raise the gastric pH to above 3·0, and if possible to 5·0 or above. While numerous antacid preparations are available in the market, all of these contain substances like magnesium hydroxide or aluminium hydroxide, which, if taken excessively, may lead to unpleasant side effects. Antacids containing magnesium for example may lead to diarrhoea if taken excessively. Food, of course, does neutralise the gastric acid, while milk has been used for peptic ulcer treatment since a long time ago. Milk, however, should not be used for Asian patients with peptic ulcer, since it may lead to abdominal pains and diarrhoea, the typical symptoms of milk intolerance. It has been shown that Asian subjects above 10 years have almost universally some degree of hypolactasia or alactasia (Bolin *et al*, 1970). Soya bean juice looks like milk, and indeed it is often called soya bean milk. It is extensively bottled for sale commercially in Singapore; and is indeed a favourite "soft" drink among the population. As it is made from the soya bean, it might have acid-neutralising properties like milk. The results of the present study confirm that this was indeed so. With a dose of 150 ml. of soya bean juice, the gastric contents could be neutralised to a pH above 3·0 for about 10 minutes. This was not due to the water it contains, since a similar dose of water did not produce any similar neutralisation. Hence, the neutralising property of soya bean juice must be due to the soya bean material itself. When compared to a very potent commercial antacid (SIMECO), soya bean juice was found to be about 1/3 as effective in terms of the duration of neutralisation. In terms of the mean pH attained, soya bean juice was also inferior to the antacid (SIMECO). This is, indeed, to be expected since the antacid (SIMECO) contains very potent alkaline substances. Soya bean juice, however, has the advantage that it is a natural foodstuff and thus entirely safe and free of ill-effects, while any standard antacid may lead to unpleasant side effects like diarrhoea. Furthermore, soya bean juice is more palatable and thus easier to take.

As the soya bean juice used in this study was the standard commercial preparation, which is quite dilute, it is most likely that a more concentrated preparation would have even greater neutralising effectiveness. It is concluded that soya bean juice has antacid properties and may be used for the relief of peptic ulcer pain. As a commercial bottle of it contains about 300 ml., the dose to be taken for continuous neutralisation would be about ½ bottle of soya bean juice every 10 minutes, until the ulcer pain subsides. It may even be given as an intragastric drip at a rate of about 1 bottle every 20 minutes, until symptoms subside. A prospective clinical trial of this should be done, and an attempt should be made to produce a more concentrated preparation of soya bean juice.

ACKNOWLEDGEMENT

Technical assistance was provided by F. C. Chung.

REFERENCES

1. Bolin, T. D., Davis, A. E. and Seah, C. S. *et al:* "Lactose intolerance in Singapore." Gastroenterology, 59, 76-84, 1970.
2. Doll, R., Price, A. V., Pygott, F. and Sanderson, P. H.: "Continuous intragastric milk drip in the treatment of uncomplicated gastric ulcer." Lancet, 1, 70-73, 1956.
3. Lawrence, J. S.: "Dietetic and other methods in the treatment of peptic ulcer." Lancet, 1, 482-485, 1952.
4. Littman, A.: "Reactive and non-reactive aluminium hydroxide gels: dose-response relationship in vivo." Gastroenterology, 52, 948-951, 1967.
5. Piper, D. W.: "Antacid and anticholinergic drug therapy of peptic ulcer." Gastroenterology, 52, 1009-1018, 1967.